

Claims:

1. A method for preparing a porous SOG film comprising the steps of preparing a solution containing an organic silane, water and an alcohol, subjecting said organic silane to acid hydrolysis or alkali hydrolysis and then heat-treating a resulting reaction system in the presence of a surfactant to thus form a porous SiO_2 film.
2. The method for preparing a porous SOG film as set forth in claim 1 wherein said method further comprises the step of repeating, at least one time, said first step for preparing said porous SiO_2 film to thus form, in order, an additional porous SiO_2 film on said porous film prepared in said first step.
3. The method for preparing a porous SOG film as set forth in claim 2 wherein said method further comprises a second step in which either of a SiO_2 film, a SiN_x film and a SiO_xN_y film is formed on said porous SiO_2 film prepared in said first step by a CVD or sputtering method to thus cap the surface of said porous film and a step of repeating said first and second steps at least one time to form a multilayered film.
4. The method for preparing a porous SOG film as set forth in claim 1 wherein after forming said porous SiO_2 film, either of a SiO_2 film, a SiN_x film and a SiO_xN_y film is formed on the surface of said porous SiO_2 film by a CVD or sputtering method to thus cap the surface of said porous film and to thus form a porous SiO_2 film.
5. The method for preparing a porous SOG film as set forth in claim 1 wherein after forming said porous SiO_2 film, unreacted OH groups remaining in said SiO_2 porous film are removed by subjecting said porous SiO_2 film to either of an oxygen plasma-treatment, an electron beam-irradiation and a UV light-irradiation treatment to thus form a porous SiO_2 film.
6. The method for preparing a porous SOG film as set forth in claim 1 wherein said heat-treatment comprises a first heat-treating step carried out at

a temperature sufficient for mainly evaporating said water and alcohol present in a reaction system and a second heat-treating step carried out at a temperature sufficient for covering at least inner walls of holes present in a resulting porous SiO_2 film with hydrophobic moieties of surfactant, said temperature used in said second step being higher than that used in said first step.

7. The method for preparing a porous SOG film as set forth in claim 6 wherein said second heat-treating step is carried out at temperatures ranging from 350 to 450 °C.

8. A method for preparing a porous SOG film comprising the steps of mixing an organic silane, water, an alcohol and an acid or an alkali, adding a surfactant to a mixture thereof to prepare an organic silane solution, spin-coating said organic silane solution on a semiconductor substrate to obtain a coated layer and then heat-treating said coated layer to evaporate said water, alcohol and surfactant and to thus form a porous SiO_2 film.

9. The method for preparing a porous SOG film as set forth in claim 8 wherein said method further comprises the steps of forming either of a SiO_2 film, a SiN_x film and a SiO_xN_y film on the surface of said porous SiO_2 film obtained after said heat-treatment by a CVD or sputtering method to thus cap the surface of said porous film and then repeating said heat-treating and capping steps at least one time to form a multilayered film.

10. The method for preparing a porous SOG film as set forth in claim 8 wherein after forming said porous SiO_2 film, either of a SiO_2 film, a SiN_x film or a SiO_xN_y film is formed on the surface of said porous SiO_2 film by a CVD or sputtering method to thus cap the surface of said porous film and to thus form a porous SiO_2 film.

11. The method for preparing a porous SOG film as set forth in claim 8 wherein after forming said porous SiO_2 film, unreacted OH groups remaining in said porous film are removed by subjecting said porous film to either of an

oxygen plasma-treatment, an electron beam-irradiation and a UV light-irradiation treatment to thus form a porous SiO₂ film.

12. The method for preparing a porous SOG film as set forth in claim S wherein said heat-treatment is carried out in two stages: in a first stage, said porous film is treated at temperatures ranging from 200 to 350 °C to thus mainly evaporate said water and alcohol and in a second stage, said porous film is treated at temperatures ranging from 350 to 450 °C to thus finish formation of said porous film, while adhering hydrophilic moieties of surfactant to at least an inner surface of holes present in a resulting porous film and to thus cover inner walls of said holes with hydrophobic moieties of said surfactant, to thus form a porous SiO₂ film.

13. The method for preparing a porous SOG film as set forth in any of claims 1 to 12 wherein said organic silane is a hydrolyzable organic oxysilane and said surfactant is a cationic surfactant.

14. The method for preparing a porous SOG film as set forth in any of claims 1 to 13 wherein said organic silane is TEOS or TMOS and said surfactant is a halogenated alkyl trimethyl ammonium type cationic surfactant such as lauryl trimethyl ammonium chloride, n-hexadecyl trimethyl ammonium chloride, alkyl trimethyl ammonium bromide, cetyl trimethyl ammonium chloride, cetyl trimethyl ammonium bromide, stearyl trimethyl ammonium chloride, alkyl dimethyl ethyl ammonium chloride, alkyl dimethyl ethyl ammonium bromide, cetyl dimethyl ethyl ammonium bromide, dimethyl ethyl octadecyl ammonium bromide or methyldodecyl benzyl trimethyl ammonium chloride.

15. The method for preparing a porous SOG film as set forth in any of claims 1 to 14 wherein said water, acid or alkali and surfactant are used in amounts ranging from 8 to 15 moles, 0.5 to 1.5 mole and 0.1 to 0.4 mole, respectively, per one mole of said organic silane.